STATUTORY DECLARATION

I, Sun Suk KIM, a citizen of the Republic of Korea and a staff member of Y.H.KIM INTERNATIONAL PATENT & LAW OFFICE specializing in "SUSCEPTOR FOR VACCUM DEPOSITION APPARATUS" do hereby declare that:

I am conversant with the English and Korean languages and a competent translator thereof.

To the best of my knowledge and belief, the following is a true and correct translation of the Priority Document (No. P2000-84714) in the Korean language already filed with Korean Industrial Property Office on December 28, 2000.

Signed this 19th day of April, 2005

Sun Suk KIM

PATENT APPLICATION

DOCUMENT NAME: PATENT APPLICATION

TO: COMMISSIONER

DATE: December 28, 2000

TITLE OF THE INVENTION:

APPLICANT(S): LG. Philips LCD Co., Ltd.

ATTORNEY(S)

Young Ho KIM

INVENTOR(S)

Name: Young Ho BAE

Address: #108-1704, Buyeong Apartment, 141, Jung-ri, Seokjeok-myeon, Chilgok-gun, Gyeongsangbuk-do, Korea

Nationality: Republic of Korea

The present application is filed pursuant to Article 42 of the Korea Patent Act.

Patent Attorney

Young Ho KIM

ABSTRACTS

[Abstract]

This invention relates to a manufacturing method of a susceptor for minimizing the breakage of a glass caused by the slide miss of the glass.

A vacuum deposition apparatus includes a susceptor applying heat to a glass substrate and generating plasma; a lift pin supporting the glass substrate; a robot arm transferring the glass substrate to and returning the glass substrate from the susceptor; a stopper pin having the transfer and return of the robot arm stable; and a furrow which is formed at a slide part of the susceptor and into which a film-forming material occurring upon a deposition process is inserted.

In the susceptor of the vacuum deposition apparatus according to the present invention, the gap of the slide part is enlarged double to make the transfer and the return of the robot arm stable, the furrow is formed at the slide part of the susceptor to reduce the breakage of the glass substrate due to the film-forming material and to improve the productivity and the rate of operation, and the exchange cycle is increased to minimize the cleaning cost and the production cost.

[Representative drawing]

Fig. 5

SPECIFICATION

[Title of the invention]

SUSCEPTOR FOR VACUUM DEPOSITION APPARATUS

[Brief description of the drawings]

Fig. 1 is a sectional view illustrating a driving apparatus of a susceptor for vacuum deposition apparatus according to a related art.

Fig. 2 is a plan view illustrating a chamber in Fig. 1.

Fig. 3 is a plan view illustrating the gap of a slide part of the susceptor.

Figs. 4a to 4d are sectional views representing sequentially a process that the glass substrate is breakdown due to a film-forming material.

Fig. 5 is a plan view illustrating a susceptor according to the present invention.

Figs. 6 to 9 are sectional view representing various furrows formed at the slide part of the susceptor.

Figs. 10a to 10c are sectional views representing that a film-forming material occurs in a furrow when the glass substrate is slid into a susceptor.

<Detailed description of the reference numerals>

2, 32 : a process chamber
4, 34 : a glass substrate
6, 369 : a lift pin
8 : a robot arm
10, 30 : a susceptor
12 : a motor
14 : a time belt
15 : a first sensor
16 : a second sensor
17 : a location sensor
18 : a support pin
20 : a supporting bar

21 : a first projected part
22 : a second projected part
23 : a sensed part
28, 40 : a stopper pin
41, 42 : a slide part
44 : a furrow

[Detailed description of the invention]

[Object of the invention]

[Technical field including the invention and prior art therein]

This invention relates to a fabricating apparatus of a liquid crystal display, and more particularly, to a manufacturing method of a susceptor for reducing the breakage of a glass caused by the slide miss of the glass in a chamber for a deposition process.

Generally, a liquid crystal display (LCD) device controls the light transmissivity of liquid crystal cells in accordance with video signals to thereby display a picture corresponding to the video signals on a liquid crystal panel having the liquid crystal cells arranged in a matrix pattern. To this end, the LCD device includes: a lower plate in which electrodes for applying an electric field to a liquid crystal layer, thin film transistors for switching a data supply for each the liquid crystal cell, a signal line for supplying data, applied from an exterior, to the liquid crystal cells, and a signal line for supplying a control signal of the thin film transistor are formed; an upper plate in which color filters, etc. are formed; a spacer formed between the upper plate and the lower plate to secure a define cell gap; and a liquid crystal material filled in a space provided between the upper and the lower plates by the spacer.

In such a fabricating method of a liquid crystal display device, active layer included in a channel part of a thin film transistor and a protective layer protecting a

transistor are generally formed by using the plasma enhanced chemical vapor deposition PECVD process. Such PECVD process is implemented by a vacuum deposition apparatus as shown in Fig. 1 and 2.

Referring to Figs. 1 and 2, a related art vacuum deposition apparatus includes a process chamber 2, and a susceptor 10 used as a lower electrode for heating a glass substrate 4 in the process chamber 2 and generating plasma. A lift pin 6 is installed on the susceptor 10 for moving the glass substrate 4 up and down. The glass substrate 4 is transferred onto the susceptor 10 by a robot arm 8, and returned after a deposition process. The susceptor 10 is fixed to a support plate 18 and positioned at a certain height within the process chamber 2 by a support bar 20 that supports the support plate 18. The susceptor 10 is made to move in a vertical direction by a time belt 14 connected to the support bar 20 and a motor 12 driving the time belt 14.

The time belt 14 driven by the motor 12 to move the support bar 20 to a desired height to thereby have the susceptor 10 moved to the corresponding position by processes. In this case, the susceptor 10 is generally moved to positions of 4 steps, that is, exchange position, load position, process position and spacing position. These positions of the susceptor 10 are determined by the driving time of the time belt 14.

The apparatus includes a location sensor 17 positioned at a side of the support bar 20 for sensing the position of the susceptor 10 and a sensed part 23 moving vertically together with the support bar 20 and being positioned in a manner of facing the location sensor 17.

The location sensor 17 is installed to be fixed and includes a first sensor 15 and a second sensor 16 that have different height and thickness from each other.

The sensed part 23 includes a first projected part 21 selectively contacting with the first sensor 15 in

accordance with the position of the susceptor 10 and a second projected part 22 contacting with the second sensor 16 by differing the location in accordance with the position of the susceptor 10. The first sensor 15 and the second sensor 16 are normally photo sensors. They generate an ON signal when they contact with the first projected part 21 and the second projected part 22 of the sensed part 23. And they generate an OFF signal when they do not contact with the first projected part 21 and the second projected part 22 of the sensed part 23. Thereby, the positions of the susceptor 10 can be sensed in the vacuum deposition apparatus.

To describe the motion of the vacuum deposition apparatus with such a composition, the robot arm 8 transfers the preheated glass substrate 4 from a heat chamber(not shown) to the process chamber 2. After moving to the process chamber 2, the robot arm 8 moves forward in the advancing direction as shown in Fig. 2, to have the glass substrate 4 positioned at the top of the susceptor 10. In this case, the robot arm 8 moves up to the home position by the time belt 14 that is driven for the time as long as being set while being not interfered by the susceptor 10 and the lift pin 6. In this way, after the glass substrate 4 is positioned at the top of the suscepotr 10 by the robot arm 8, the susceptor 10 moves up to the load position by the time belt 14 that is driven for the time as long as being set, so that the glass substrate 4 is supported by the lift pin 6. At this moment, the robot arm 8 does not contact with the glass substrate 4 and the susceptor 10. On the other hand, the first projected part does not contact with the first sensor 15 while the second projected part 22 of the sensed part 23, which moves up with the support bar 20, contacts with the second sensor 16 of the location sensor 17.

Thus, when the susceptor 10 is positioned at the load position, the robot arm 8 comes out of the process chamber.

When the robot arm 8 comes out, the susceptor 10 moves up to the process position by the time belt 14, which is driven for the time as long as being set.

At the same time, the lift pin 6 supporting the glass substrate 4 is inserted into the inside of the susceptor 10 so that the glass substrate 4 is positioned on the surface of the susceptor 10. At this moment, the ON signal is generated from the first sensor 15 and the second sensor 16 of the sensed part 23 that moved up with the support bar 20 of the susceptor 10. Consequently, after moving up to the spacing position as the next position, the susceptor 10 applies heat and voltage to the glass substrate 4 to have a desired film deposited on the glass substrate 4 by gas and plasma. And, when the deposition process is completed, the time belt 14 is driven in the reverse direction that is different from the above described sequence, and the susceptor 10 carries out the foregoing process in a reverse order so that the glass substrate 4 is conveyed to a succeeding process equipment by the robot arm 8.

Thus, in the process position among the motions of the related art vacuum deposition apparatus, the vacuum deposition apparatus, as shown in Fig. 3, includes the process chamber 2, the susceptor 10 on which the glass substrate 4 is safely placed within the process chamber 2, and the lift pin 6 supporting the glass substrate 4.

The glass substrate 4 is slid by the robot arm 8 and safely placed on the surface of the susceptor 10. At this moment, the susceptor 10 applies heat to the glass substrate 4 and is used as a lower electrode for generating plasma.

The robot arm 8 transfers the pre-heated glass substrate 4 from the heat chamber(not shown) to the process chamber 2. After moving to the process chamber 2, the robot arm 8 moves forward to the advance direction to have the glass substrate 4 positioned at the top of the susceptor 10. At this moment, the lift pin 6 supporting

the glass substrate 4 is inserted into the inside of the susceptor 10 to have the glass substrate 4 positioned at the surface of the susceptor 10.

At the moment, the robot arm 8 put the glass substrate 4 at 2~3 mm before a stopper pin 28 from the end of the glass substrate 4. At this time, it become unstable upon the transfer and the conveyance of the robot arm 8 because the gap of the stopper pin 28 and a slide part where the glass substrate 4 is safely placed, is 5 mm.

Also, the robot arm 8 is inclined in around 85 degree and moves up for safely placing the glass substrate 4 on the surface of the susceptor 10. Due to this, upon safely placing the glass substrate 4 on the susceptor 10, it happens being inclined to and thronged at a side.

Consequently, the friction between the surface of the susceptor 10 and the glass substrate 4 becomes different so that film-forming material occurs at the slide part of the susceptor 10.

Figs. 4a to 4d are sectional views representing the process that the glass substrate 4 is damaged by the film-forming material which occurs on the surface of the susceptor 10 due to the friction difference between the surface of the susceptor 10 and the glass substrate 4 safely placed on the susceptor 10 in the manner of being inclined.

When the glass substrate 4 is slid into the slide part 41 of the susceptor 10, it happens to be caught by the film-forming material 11 to have the slide miss occur. Thereby, there occurs a problem that the glass substrate 4 is broken. Particularly, the possibility of its occurrence increases because a bend of the substrate becomes severe due to the enlargement of the substrate. Also, there is difficulty in obtaining the material because pyrex, a kind of glass, is used for the susceptor 10 as its material.

[Technical Subject Matter to be solved by the Invention]

Accordingly, it is an object of the present invention to provide a susceptor for a vacuum deposition apparatus to reduce the breakage of a glass by changing a shape between a material and a friction contact part and a gap between the material and a lower part placed on a glass substrate.

[Configuration and Operation of the Invention]

In order to achieve these and other objects of the invention, a susceptor for a vacuum deposition apparatus according to the present inventon: a susceptor applying heat to a glass substrate and generating plasma; a lift pin supporting said glass substrate; a robot arm transferring said glass substrate to and returning said glass substrate from said susceptor; a stopper pin having the transfer and return of said robot arm stable; and a furrow which is formed at a slide part of said susceptor and into which a film-forming material occurring upon a deposition process is inserted.

These and other objects of the invention will be apparent from the following detailed description of the embodiments of the present invention with reference to the accompanying drawings.

Hereinafter, the preferred embodiments of the present invention will be described in detail with reference to Figs. 5 to 10c.

Fig. 5 shows a process position in motion processes of a vacuum deposition apparatus according to the present invention. The vacuum deposition apparatus according to the present invention includes a process chamber 32, a susceptor 30 in which a glass substrate 34 is safely placed in the process chamber 32, a furrow 44 formed at a slide part 42 of the susceptor 30; and a supporting pin 36 for supporting the glass substrate 34.

The glass substrate 34 is safely placed on the surface of the susceptor 30 by a robot arm 8 upon sliding. The susceptor 30 is used as a lower electrode for applying heat

to the glass substrate 34 and generating plasma. The furrow 44 minimizes a contact of the slide part 42 caused by a film-forming material.

The robot arm 8 transfers to the process chamber 32 the glass substrate 34 pre-heated at a heat chamber(not shown). After moving to the position of the process chamber 32, the robot arm 8 moves forward to an advance direction and has the glass substrate 34 placed on top of the susceptor 30 while the supporting pin 36 supporting the glass substrate 34 is inserted into the inside of the susceptor 30 so that the glass substrate 34 is positioned on the surface of the susceptor 30.

The robot arm 8 puts the glass substrate 34 at 2~3 mm before a stopper pin 40 from the end of the glass substrate 34 when safely placing the glass substrate 34 on the surface of the susceptor 30. At this time, to make the transfer stable upon the transfer and the conveyance of the robot arm 8, the gap between the end part of the glass substrate 34 and the stopper pin 40 is increased to be 10 mm. Thereby, the transfer and the conveyance of the robot arm 8 become stabilized.

Also, because the glass substrate 34 is put on the surface of the susceptor 30 with an angle of 85 degree for being safely placed, the glass substrate 34 is safely placed on the susceptor 30 as being inclined to one side. As a result, the friction between the susceptor30 and the glass substrate 34 becomes different to have the film-forming material occurs at the slide part 42 of the susceptor 30.

To minimize the occurrence of the side miss of the glass substrate 34 owing to the film-forming material, a furrow 44 is formed at the slide part 42 of the susceptor 30 as shown in Fig. 6 to 9.

Figs. 6 to 9 are sectional views enlarging 'A' portion in Fig. 5, and represent various shapes of the furrow 44.

Referring to Figs. 6 to 9, the furrow 44 has a shape

that the sectional surface includes a polygon shape, the bottom surface includes a curved surface, and the bottom surface includes an incline plane and a perpendicular plane.

The furrow 44 makes the contact surface with the film forming material minimized, as shown in Figs. 10a to 10c, when the glass substrate 34 is slid.

Figs. 10a to 10c are sectional views representing by steps that at the furrow 44 occurs the film-forming material taking place by the friction between the glass substrate 34 and the slide part 42. When the glass substrate 34 is slid to the slide part 42 of the susceptor 30, the film-forming material taking place by the friction difference between the glass substrate 34 and the susceptor 30 occurs the inside of the furrow 44 so that the film-forming material does not contact with the glass substrate 34.

In this way, when the glass substrate 34 is slid to the susceptor 30, the film-forming material occurs inside of the furrow 44. Thereby, the breakage of the glass substrate 34 is prevented.

On the other hand, the related art susceptor 10 uses pyrex, a kind of glass. On the contrary, the susceptor 30 according to the present invention uses quartz as its material, to make it easy to supply the material.

[Effect of the Invention]

As described above, with the susceptor for the vacuum deposition apparatus according to the present invention, the gap of the slide part is enlarged double to make the transfer and the return of the robot arm stable, the furrow is formed at the slide part of the susceptor to reduce the breakage of the glass substrate due to the film-forming material and to improve the productivity and the rate of operation, and the exchange cycle is increased to minimize the cleaning cost and the production cost.

Although the present invention has been explained by

the embodiments shown in the drawings described above, it should be understood to the ordinary skilled person in the art that the invention is not limited to the embodiments, but rather that various changes or modifications thereof are possible without departing from the spirit of the invention.

[What is claimed is:]

1. A susceptor for vacuum deposition apparatus comprising:

a susceptor applying heat to a glass substrate and generating plasma;

a lift pin supporting said glass substrate;

a robot arm transferring said glass substrate to and returning said glass substrate from said susceptor;

a stopper pin having the transfer and return of said robot arm stable; and

a furrow which is formed at a slide part of said susceptor and into which a film-forming material occurring upon a deposition process is inserted.

2. The susceptor for vacuum deposition apparatus according to claim 1, wherein the gap between said slide part and said stopper pin is at least 3 mm.

3. The susceptor for the vacuum deposition apparatus according to claim 1, wherein said gap is 10 mm.

4. The susceptor for vacuum deposition apparatus according to claim 1, wherein material of said susceptor is quartz.

5. The susceptor for vacuum deposition apparatus according to claim 1, wherein the section of said furrow formed in said slide part has a shape of polygon.

6. The susceptor for vacuum deposition apparatus according to claim 1, wherein the bottom face of said furrow formed in said slide part has a curved shape.

7. The susceptor for vacuum deposition apparatus according to claim 1, wherein the bottom face of said

furrow formed in said slide part includes an incline plane and a perpendicular plane.

FIG.1

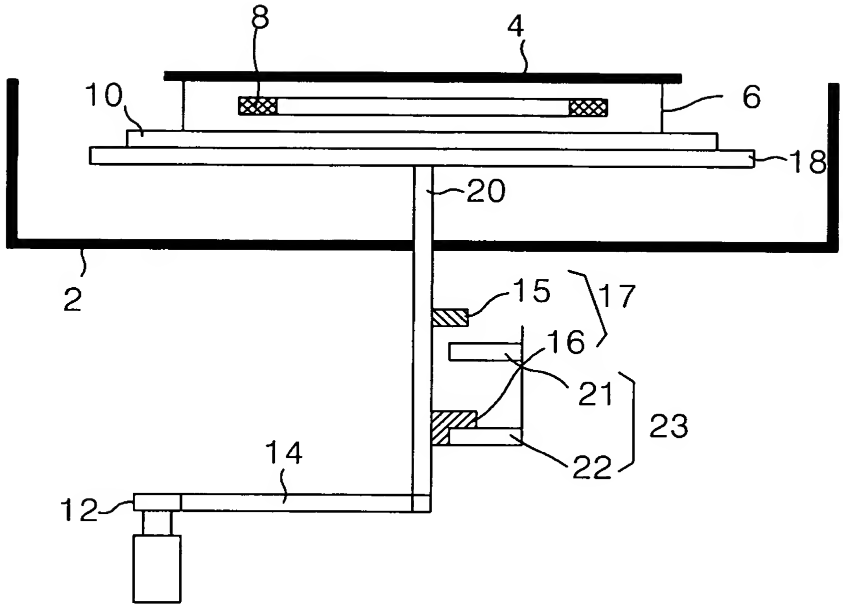

FIG.2

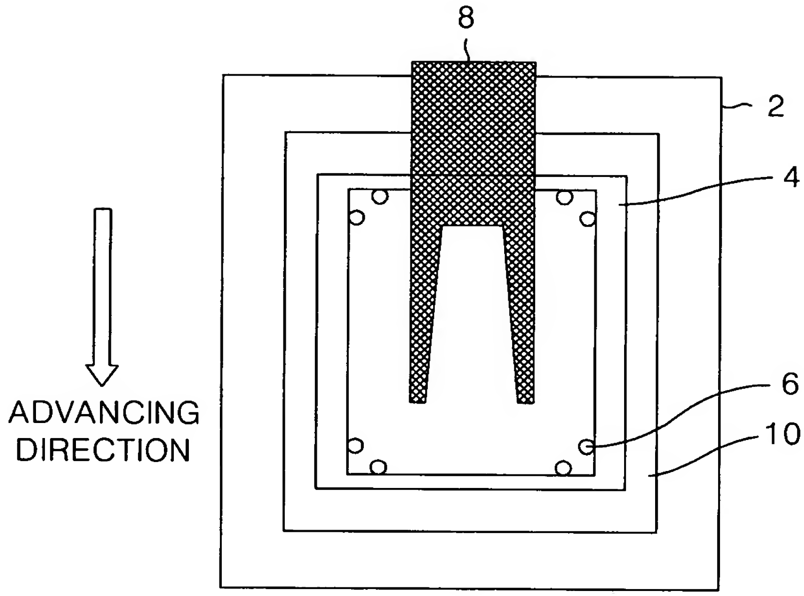

FIG.3

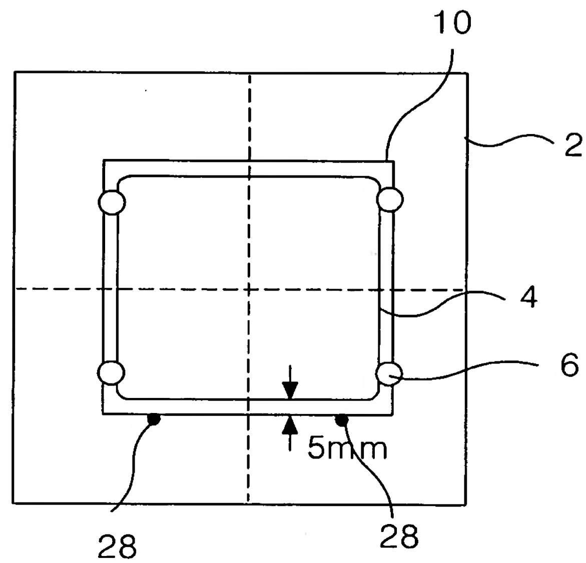

FIG.4A

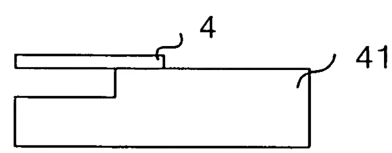

FIG.4B

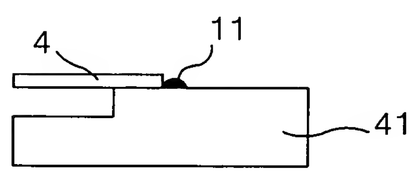

FIG.4C

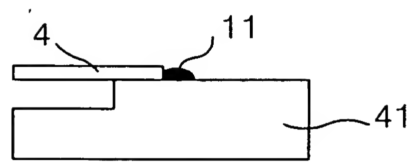

FIG.4D

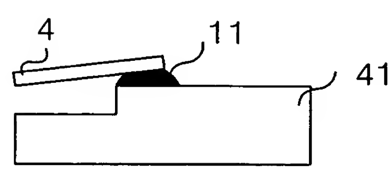

FIG.5

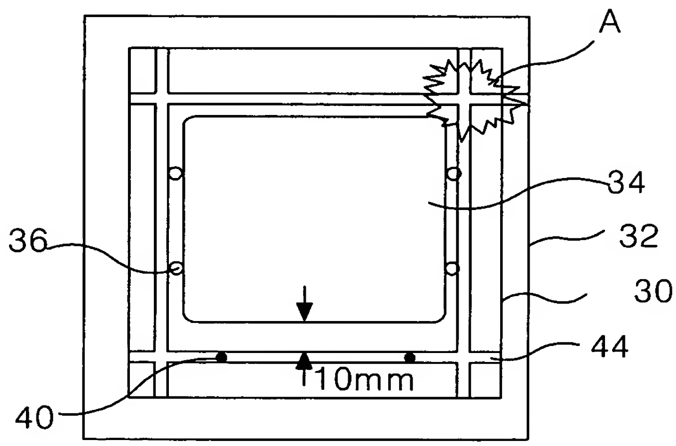

FIG.6

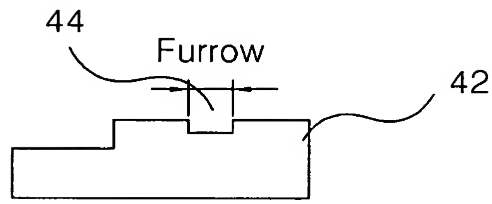

FIG.7

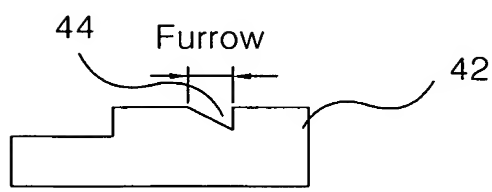

FIG.8

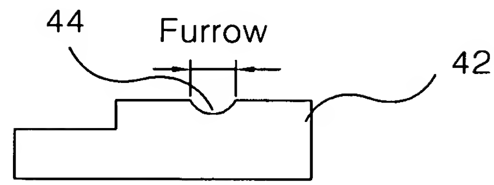

FIG.9

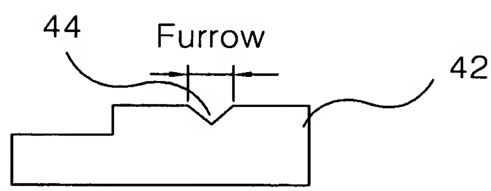

FIG.10A

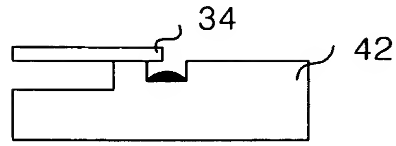

FIG.10B

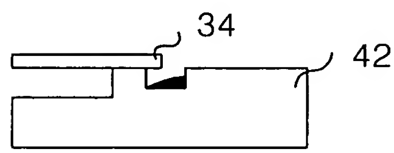

FIG.10C